CLAIMS

I claim:

1. A composition comprising an electrode with a covalently attached redox active complex comprising a binding ligand and a solvent accessible transition metal complex.

2. A composition according to claim 1 wherein said solvent accessible transition metal complex has at least two coordination sites occupied by polar coordination groups.

3. A composition according to claim 1 wherein said solvent accessible transition metal complex has at least one coordination site occupied by a water molecule.

4. A composition according to claim 1 wherein said electrode further comprises a self-assembled monolayer.

5. A composition according to claim 1 wherein said solvent accessible transition metal complex is covalently attached to said electrode via a conductive oligomer.

6. A composition according to claim 1 wherein said solvent accessible transition metal complex is linked to said binding ligand to form a redox active complex.

7. A composition according to claim 1 wherein said binding ligand is covalently attached to said electrode via a conductive oligomer.

8. A method according to claim 1, wherein said solvent accessible transition metal complex has a solvent reorganization energy of greater than about 1200 mV.

9. A method of detecting a target analyte in a test sample comprising:

a) binding an analyte to a redox active complex comprising:

i) a solvent accessible transition metal complex having at least one coordination site occupied by a polar coordination group; and

ii) a binding ligand that will bind the target analyte;

wherein said redox active complex is bound to an electrode, such that upon binding, a solvent inhibited transition metal complex is formed; and

b) detecting electron transfer between said solvent inhibited transition metal complex and said electrode.

10. A method according to claim 9, wherein said solvent accessible transition metal complex has a solvent reorganization energy of greater than about 1200 mV and said solvent inhibited transition metal complex has a solvent reorganization energy of less than 1000 mV.

11. A method according to claim 9, wherein the solvent reorganization energy of said solvent inhibited transition metal complex decreases by at least 100 mV upon binding of said analyte to form said solvent inhibited transition metal complex.

12. A method according to claim 9, wherein upon binding, at least one solvent accessible transition metal complex is less than 8 Å from the bound analyte such that it forms said solvent inhibited transition metal complex.

13. A method according to claim 9, wherein said polar coordination group is a water molecule.

14. A method according to claim 9 further comprising applying at least a first input signal to said solvent inhibited transition metal complex.

15. A method according to claim 14 wherein in the absence of target analyte, said first input signal does not result in significant electron transfer.

16. A method according to claim 14, wherein said first input signal comprises at least an AC component.

17. A method according to claim 14 further comprising applying input signal at a plurality of frequencies.

18. A method according to claim 14, wherein said first input signal comprises at least a DC voltage.

19. A method according to claim 18 further comprising applying input signal at a plurality of voltages.

20. A method according to claim 9 wherein said detecting is by receiving an output signal characteristic of electron transfer between said solvent inhibited transition metal complex and said electrode.

21. A method according to claim 20 wherein said output signal is a current.

22. A method according to claim 21 wherein said current is an AC current.

23. A method according to claim 9, wherein said binding ligand is covalently attached to said solvent accessible transition metal complex.

24. A method according to claim 9, wherein said ligand is covalently attached to said electrode.

25. A method according to claim 9, wherein said solvent accessible transition metal complex is covalently attached to said electrode.

26. A method according to claim 25 wherein said covalent attachment is via a conductive oligomer.

27. A method according to claim 9, wherein said analyte is a biomolecule.

28. A method according to claim 27, wherein said biomolecule is selected from the group consisting of proteins, carbohydrates, and lipids.

29. An apparatus for the detection of target analytes in a test sample, comprising:

a) a test chamber comprising a first and a second measuring electrode, wherein said first measuring electrode comprises a covalently attached redox active complex comprising:

i) a solvent accessible transition metal complex having at least one coordination site occupied by a polar coordination group; and

ii) a binding ligand;

b) an AC/DC voltage source electrically connected to said test chamber.

30. An apparatus according to claim 29 wherein said covalent attachment is via a spacer.

31. An apparatus according to claim 29 further comprising a processor coupled to said electrodes.

32. An apparatus according to claim 29 wherein said electrode further comprises a self-assembled monolayer.